## REMARKS

Reconsideration is respectfully requested.

By the above Amendment, Claims 1, 9, 11 and 14 have been amended to more clearly delineate and recite the features considered by the Applicants to comprise their invention.

With respect to the substantive rejection, Applicants respectfully submit that the rejections of Claims 1-20 under 35 U.S.C.§103(a) based on the Applicants' admitted prior art (AAPA) in view of Ota et al. and Channin are now improper, in view of the amendments and a proper understanding of the invention as opposed to the prior art.

To provide a better understanding of the presently claimed invention as distinguishing the prior art, Applicants herewith provide a context of the invention.

The description of the electrode structure is best understood in light of an explanation for the driving theory of the IPS mode versus the FFS mode which is the subject of the present invention, as described in the specification. Such an explanation for the driving difference between the FFS and IPS modes should be understood in light of the attached drawings.

Firstly, taking the structure in cross-section and if the electric field is divided roughly into two in the cell region, the first section is between the electrodes (a source electrode and a common electrode) and the second section is the upper portion of the electrode.

The explanation that the driving difference of the two sections is that of FFS mode and IPS mode is as follows. In the case of the IPS mode, a horizontal field in the Y direction is formed between the electrodes at the first section, which can drive the LCD

whereas in the upper portion of the electrode at the second section, a perpendicular field is formed in the Z direction, which cannot drive the LCD. There is no mention in either cited reference (Ota et al. or Channin) that the LCD is driven in the upper portion of the electrode.

However, in the case of the inventive FFS mode, a fringe field is formed between the electrodes at the first section, which is divided into a horizontal field extending along the Y direction, and which can drive the LCD and a perpendicular field in the Z direction which cannot drive the LCD. Also, in the upper portion of the electrode at the second section, a fringe field is formed, which is divided into a horizontal field in the Y direction and a perpendicular field in the Z direction. The LCD is driven by the component which is taken along the Y direction.

In other words, a component of the field in the Y direction at the upper portion of the electrode exists in an FFS mode, which is different from that of the IPS mode. Thus, it is a significant difference from the driving force in the IPS mode that transmittance and brightness can be improved since the upper portion of the electrode is driven, which is not possible in an IPS mode.

Therefore, in the case of the IPS mode, an improvement in transmittance cannot be expected since the LCD is not driven whether it is a metal electrode or a transparent electrode. However, in the case of the FFS mode, a transparent electrode should be used, which provides the benefit of the improvement in transmittance.

Also, to form a fringe field as claimed, the gap between the electrodes should be smaller than the cell gap. In light of those two distinguishing features, that is, the FFS mode having a component in the Y direction acting on the upper portion of the electrode

and the FFS mode having a gap between the electrodes smaller than the cell gap, as applied to the reflective liquid display device in the present application, the rejections are considered to have been overcome.

Additionally, Applicants disagree with the contention that it would have been obvious to combine the Channin reference with AAPA and/or Ota et al., since as explained in the Response filed on June 18, 2002, Page three, Channin is drawn to a "liquid crystal lens", and not to an LCD, as recited in the claims of this application.

As is well known in making a determination of obviousness, the mere presence of the elements of a claim in the prior art, without a teaching reference or some type of incentive, other than that described and taught in the application being examined, is necessary to show the desirability and technical feasibility of the proposed combination of teachings taken from the references. It is insufficient to propose a mere "modification" to one teaching (the AAPA) in view of the teachings taken from another reference, for example, Ota et al. and Channin. To simply state that the teachings of two disparate reference are combinable, without providing reasons as to why the practitioner having ordinary skill in the art would be led to making the proposed combination, is contrary to the standards of obviousness.

In the case of the proposed combination, the rejection of the claims of the present application fail to set forth an adequate teaching, suggestion or even incentive for making the proposed combination. At best, in the rejection set forth at Page 3 of the Office Action, dated December 18, 2001, Channin is relied upon as teaching that the "purpose of making the distance between the substrate greater than the distance between the electrodes is to improve the changes in the direction of propagation of the light rays

passing through such a cell (see Col. 3, lines 39-53 and Figure 4)". Leaving aside the issues of whether Channin is analogous art (Channin is drawn to a liquid crystal lens, not a liquid display (LCD), as claimed herein), and whether Channin actually teaches that for which it is relied upon, (the cited portion of Channin does not teach the limitation, for example, that the distance between the substrates "is greater than the distance between the branch of the counter electrode and the strip of the pixel electrode" as recited in Claim 1; at best, Channin teaches that the "ratio of the width of the liquid crystal layer 24 to the inter-electrode spacing, or aspect ratio, thus varies from about 0.5 to about 2.0," at least a portion of which is outside the claimed range), the very reference relied upon in the statement of obviousness, Channin, itself teaches against the proposed combination. Reference is made to Column 1, lines 47 to 65 of Channin, which, as a description of the prior art, cites the reference to Soref, U.S. Patent No. 3,807,381, drawn to an LCD device. Soref is said to teach a liquid crystal layer in which "the liquid crystal layer thickness varied from 0.5 micron to about 1.5 microns and the aspect ratio…varied from 0.04 to 0.15." Soref, however, was found not to be relevant by the inventor to Channin's invention because as set forth in Channin, "Soref does not teach the use of such a device as a lens." Thus Channin distinguishes the use of an aspect ratio of a desirable size in an LCD, because it is drawn to a liquid crystal lens. Accordingly, the Examiner's suggestion that Channin teaches or suggests the proposed combination is belied by the reference when understood to make an actual description, that use in an LCD device is so different from use in a lens structure that the two are not relevant, and are thus distinguished.

Ota et al. similarly teaches against the proposed combination, because Ota et al. is drawn to an active matrix type LCD apparatus. As set forth in Ota et al., Column 1, lines

8-54, the invention of Ota et al. is drawn to, and applicable in devices for an active LCD, that is, one in which "the liquid crystal is operated by an electric field which is disposed parallel to a substrate plane between two electrodes composed on the similar substrate, and an image is displayed by undulating incident light into the liquid crystal through a gap between the two electrodes." This active LCD is said to be preferable to the one where the liquid crystal is held between two substrates because "it has preferable features, such as wide viewing angles," Column 1, line 29. Thus, Ota et al. teach that the active LCD is preferable because it can produce a wider viewing angle. This is not a teaching that an LCD according to the present invention should be modified to produce a wider viewing angle; to the contrary, Ota et al. teach that one should not modify an LCD in which the liquid crystal is held between two substrates, but one should utilize an active LCD to achieve a wider viewing angle. The very purpose which is described and claimed as a feature of the present invention is taught by Ota et al. to found in a device different from that which is claimed. The types of devices, the elements of which are recited in Claims 1 and 9, are distinguished by Ota et al. because they belong to a different category, Column 1, lines 13-22. Thus, it is respectfully suggested that the proposed combination, that is, an LCD as claimed, cannot be taught by reliance on AAPA in view of two secondary references, which each teach against the very combination proposed in the Office Action.

For these reasons, Applicants respectfully request reconsideration and withdrawal of the rejections, made under 35 U.S.C.§103(a), as being improper. In view of the Applicant's overcoming of the rejections, and in view of the amendments made to Claims

1, 9, 11, and 14, it is respectfully suggested that the application is allowable and an indication thereof is earnestly solicited.

Respectfully submitted,

December 2, 2002

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## MARKED UP VERSION OF CLAIMS 1, 9, 11 AND 14

1. (Twice Amended) A reflective liquid crystal display (LCD) of high aperture ratio, high transmittance and wide viewing angle comprising:

a lower substrate; [and]

an upper substrate opposed to the lower substrate and being separated therefrom by [with] a selected first distance;

a liquid crystal layer sandwiched between the lower and [the] upper substrates [and] comprising a plurality of liquid crystal molecules;

a gate bus line and a data bus line formed on the lower substrate to define a pixel;

a counter electrode and a pixel electrode formed at an inner surface of the lower substrate wherein both electrodes are formed [with] having a selected distance separating said electrodes and a selected width so that most of the liquid crystal molecules in upper portions of those electrodes are sufficiently driven by forming a fringe field between said counter and pixel electrodes;

a thin film transistor provided adjacent to an intersection of the gate bus line and the data bus line and transmitting a signal of the data bus line into the pixel electrode when the gate bus line is selected;

a polarizing plate disposed at an outer surface of the upper substrate;

a reflecting plate disposed at an outer surface of the lower substrate; and

a quarter wave plate sandwiched between the reflecting plate and the lower substrate[, or between the polarizing plate and the upper substrate],

wherein both counter and pixel electrodes are made of a transparent conductor, and wherein [a] the selected distance between the upper and lower substrates is greater [in length] than the selected distance between the counter and pixel electrodes.

AB

9. (Twice Amended) A reflective liquid crystal display (LCD) [of] having high aperture ratio, high transmittance and a wide viewing angle comprising:

a lower substrate; [and]

an upper substrate opposed to the lower substrate and being separated therefrom by [with] a selected first distance;

a liquid crystal layer sandwiched between the lower and [the] upper substrates [and] comprising a plurality of liquid crystal molecules;

a gate bus line and a data bus line formed on the lower substrate to define a pixel;

a counter electrode formed at each pixel of the lower substrate, transmitted with the common signal and having a plurality of branches diverged in parallel with the data bus line and at least a bar for connecting the branches, wherein the respective branches have a first width and [they] are spaced and separated by [with] a second distance;

a pixel electrode having a plurality of strips formed between the respective branches of the counter electrode, having a second width, and spaced apart by a third distance, and at least a bar for connecting the strips, wherein the second width is smaller in length than the second distance, and the first width is smaller in length than the third distance;

a thin film transistor provided adjacent to an intersection of the gate bus line and the data bus line and transmitting a signal of the data bus line into the pixel electrode when the gate bus line is selected;

a polarizing plate disposed at an outer surface of the upper substrate;

a reflecting plate disposed at an outer surface of the lower substrate; and

a quarter wave plate sandwiched between [the reflecting plate and the lower substrate or between] the polarizing plate and the upper substrate,

wherein both counter and pixel electrodes are made of a transparent conductor,

wherein [a] the first distance between the upper and lower substrates is greater [in length] than the second distance between the branch of the counter electrode and the strip of the pixel electrode, and

wherein the first and second widths are set such that the liquid crystal molecules in upper portions of the branch of the counter electrode and the strip of the pixel electrode are aligned by the electric field between adjacent branches and strips.

11. (Amended) A [The] reflective liquid crystal display (LCD) [of claim 9] having high aperture ratio, high transmittance and a wide viewing angle comprising:

a lower substrate;

an upper substrate opposed to the lower substrate and being separated therefrom by a selected first distance;

a liquid crystal layer sandwiched between the lower and the upper substrates comprising a plurality of liquid crystal molecules;

a gate bus line and a data bus line formed on the lower substrate to define a pixel;

a counter electrode formed at each pixel of the lower substrate, transmitted with the common signal and having a plurality of branches diverged in parallel with the data bus line and

at least a bar for connecting the branches, wherein the respective branches have a first width and are spaced and separated by a second distance;

a pixel electrode having a plurality of strips formed between the respective branches of the counter electrode, having a second width, and spaced apart by a third distance, and at least a bar for connecting the strips, wherein the second width is smaller in length than the second distance, and the first width is smaller in length than the third distance;

a thing film transistor provided adjacent to an intersection of the gate bus line and the data bus line and transmitting a signal of the data bus line into the pixel electrode when the gate bus line is selected;

a polarizing plate disposed at an outer surface of the upper substrate;

a reflecting plate disposed at an outer surface of the lower substrate; and

a quarter wave plate sandwiched between the polarizing plate and the upper substrate,

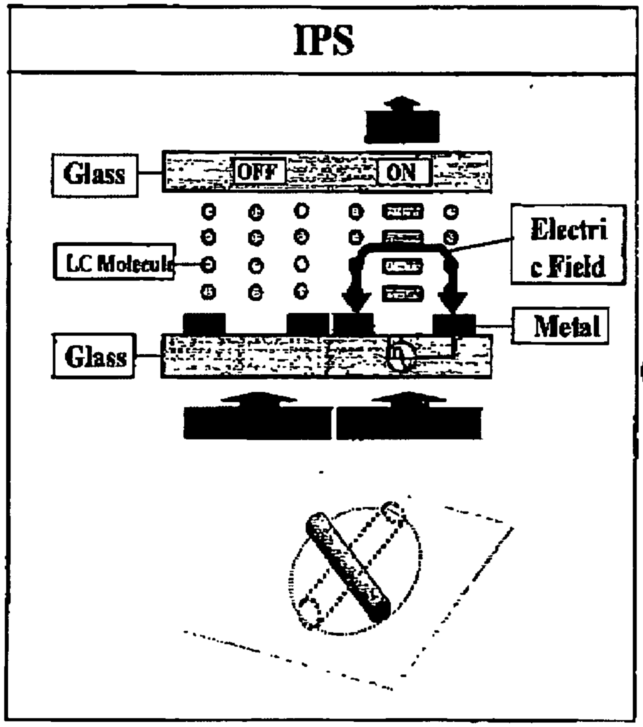
wherein both counter and pixel electrodes are made of a transparent conductor,

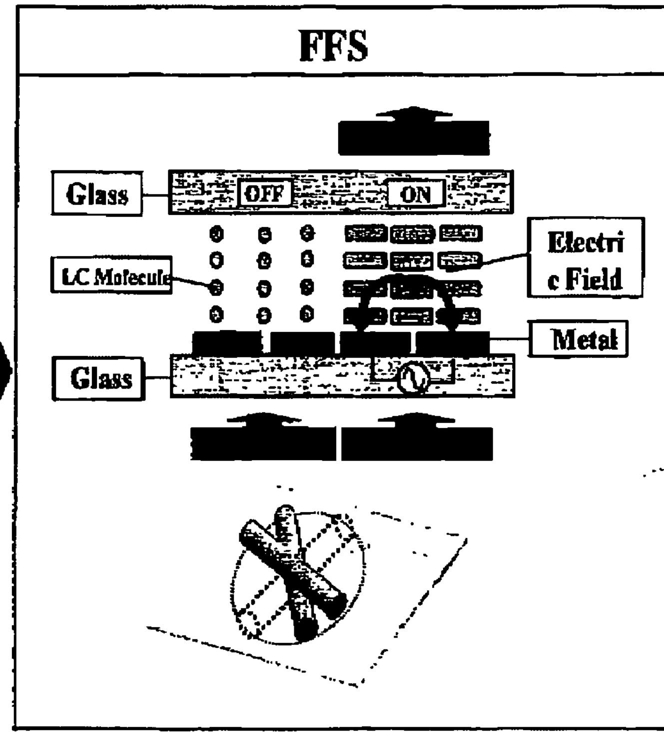
wherein the first distance between the upper and lower substrates is greater than the second distance between the branch of the counter electrode and the strip of the pixel electrode, and

wherein the first and second widths are set such that the liquid crystal molecules in upper portions of the branch of the counter electrode and the strip of the pixel electrode are aligned by the electric field between adjacent branches and strips.

14. (Twice Amended) The reflective LCD of Claim 13, wherein the dimensions of the first width and the second width are in the range of 2[~] to 8$\mu$m respectively.

# *Fringe-Field Switching (FFS)*



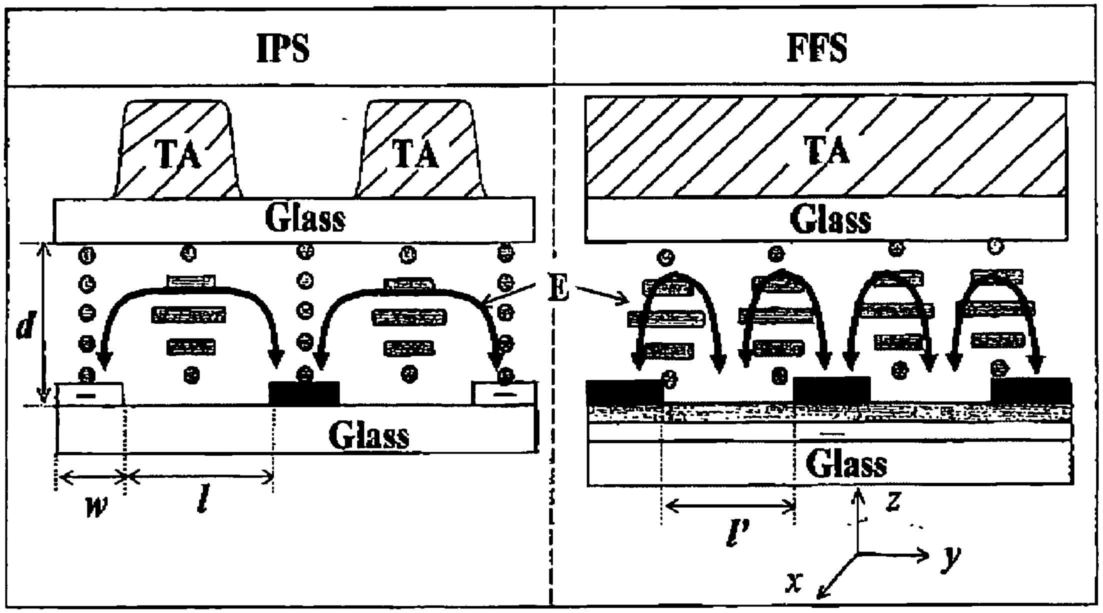




$T=T_o \sin^2 2\Phi \sin^2(\pi d \Delta n/\lambda)$

**Φ: An angle between crossed polarizers & liquid crystal director**

**Fringe-Field Switching (FFS): Wide Viewing Angle and High Transmittance**

# *Fringe-Field Switching (FFS)*




| | IPS | FFS |
|---|---|---|
| *l / d* | >1 | <1 or 0 |
| *l / w* | >1 | <1 or 0 |
| *Field(between electrodes)* | $E_y$ | $E_y$, $E_z$ |
| *Field(upper of electrode)* | $E_Z$ | $E_y$, $E_z$ |
| *Electrodes* | Metals or ITO | ITO |